

EFFECTS OF ONCE VS TWICE DAILY PHYSIOTHERAPY SESSION ON 6MWT FOLLOWING CARDIAC SURGERY

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ABSTRACT

Physiotherapy intervention is beneficial in terms of prevention of postoperative complications and improves functional capacity. However, limited evidences on optimal exercise prescription for post CABG patients. Therefore, this study intended to compare of functional capacity between once and twice daily physiotherapy interventions following Coronary Artery Bypass Graft patients. This double-blind randomized controlled trial. After surgery, 62 patients were randomly assigned across 2 groups. Group 1 received once daily physiotherapy intervention which included deep breathing exercises, incentive spirometer, chest physiotherapy and early mobilization. Group 2 received twice daily physiotherapy intervention with similar protocol as Group 1. 6MWT were assessed on post-operative day 2 and were reassessed before discharged. 62 patients, 58 (93.5%) males were included, with a mean age of 58 ± 9.8 years. After the analysis, both groups had significant increase in the 6MWT mean distances before discharge (Group 1: 119.2 ± 20.9 vs 277.6 ± 25.7 m, $p=0.00$; Group 2: 127.6 ± 24.9 vs 298.5 ± 36.9 m, $p=0.00$). Group 2 had significant difference in overall mean difference of 6MWT (14.7 m, $p=0.019$). The mean distance in the present study did not meet the 25 meters MCID. However, the 6MWD MCID values of 25 meters still fall within the upper bound of the confidence interval 14.66 ± 26.84 , ± 2.47 . The twice daily physiotherapy intervention had significant effects in 6MWT distances.

Keywords: *exercise; functional capacity; cardiac rehabilitation; early mobilization.*

Introduction

World Health Organization (WHO) reported that non-communicable diseases (NCDs) constituted approximately 17.9 million fatality, accounting for about 32% of all global death. CHD remained as the main cause of death among all CVDs by 15.6% in 2019 (Wan Musa et al., 2022). Coronary artery bypass graft (CABG) is the primary revascularisation options in obstructive coronary artery disease (Ram et al., 2018). Exercise programmes have been shown to aid recovery in the post-operative stage (Min et al., 2023), help maintain optimal functioning of organs, promote a healthy, active lifestyle and reduce the length of hospital stay (Luan et al., 2019). Functional walking tests have readily interpretable findings that are applicable to daily activities and practices (Pollentier et al., 2010). In a number of clinical populations, includes COPD, congestive heart failure (CHF) and asthma, the distance covered in the 6MWT was found to associate closely with maximal oxygen intake and maximum functioning ability reached during cardiopulmonary exercise testing (CPETs).

However, limited evidence on optimal exercise prescription for post CABG patients. Frequency of 2-4 times per day (days 1-3) for early mobilisation for patients after cardiac surgery and intensity based on HR rest + 30beats/min (upper limit ≤ 120) or rate of perceived exertion (RPE) ≤ 13 (6-20 scale) was recommended as one of the guidelines in post-operative physiotherapy managements (Hirschhorn et al., 2012). However, Wasfy et al., (2016) also stated that the optimal dose of exercise for inpatients remains to be better defined. To date, there are no current Malaysian national guidelines on post-operative exercise/mobility prescription for this patient group. The aims of this study were to investigate the outcome measures of two groups of subjects following Coronary Artery Bypass Graft (CABG) surgery.

Methodology

This study is a prospective, parallel-group, concealed allocation, randomised controlled, patient and assessor-blinded clinical trial at Institut Jantung Negara, Kuala Lumpur, Malaysia. Total sample size is 62, with 31 participants in each group. 1. Control group (once daily physiotherapy) and 2. Intervention group (twice daily physiotherapy). The potential participants were given verbal and written information's about the study and consent form. The inclusion criteria includes first time CABG. Exclusion criteria were patients with a past medical history (Patman et al. 2001) and patients who develop complications after surgery for example, stroke, bleeding, seizures (Hirschhorn et al. 2012). Participants were stratified before being randomly allocated to Groups 1 and 2 based on gender, BMI categories, NYHA classification and EF percentages categories.

All the interventions were performed by three qualified IJN physiotherapists who are competent in rendering physiotherapy services. Principal physiotherapist was assigned to monitor and mentor all the physiotherapists to ensure all the treatments provided were standard. Pre-operative education was given to both groups prior to surgery. The routine physiotherapy post-operative day one consisted of breathing exercises, huffing/coughing/percussion/vibration (if indicated), limbs exercise on bed and sitting out of bed with physiotherapy assistance. Post-operative day two physiotherapy treatments included similar intervention with active free limbs exercise and supervise walking (RPE of 11-12/20). On post-operative day three, similar intervention with active free exercises with 1 lb dumbbell and supervised walking (RPE 11-12/20). On post-operative day four and onward, the physiotherapy session consisted same intervention with active free exercises with 1lb dumbbell

(RPE 12-13/20) and gradually increased. Cardiac rehabilitation in the gym which included cycling, treadmill or 6MWT, ascent and descent of stairs (RPE of 12-13/20) until the participants were discharged from IJN. Upon discharged, physiotherapists educate both groups regarding the progression of exercises and activity for the first 2 months. The pre-intervention data measurements on first- and second-day post-surgery and post-intervention data measurements were done before being discharged.

All data analyses were conducted using statistical software version 27 of the Statistical Package for Social Science (SPSS). Socio-demographic statistics were analysed as the mean and percentage. Based on demographic data, a descriptive analysis of the research population was presented. Mean, standard deviation and frequency were shown as a continuous variables. The effect of differences before and after therapy in both groups, repeated measures of ANOVA were used in the study. Assumption of normality, compound symmetry and homogeneity of variance were assessed and fulfilled before the repeated measure ANOVA analysis was executed. The statistical significance level was set at $p < 0.05$. Studies were approved by the Human Research Ethics Committees: KPJ University Ethics Committee (KPJUC/RMC/SOHS/EC/2019/234) and Institut Jantung Negara, Ethics Committee (IJN/REC/430/2019).

Result

A total of 62 post-CABG surgery patients involved in this study were divided into two groups, Group 1 (once daily physiotherapy) and Group 2 (twice daily physiotherapy).

Table 1. Socio - demographic characteristics among subjects

Age (Years)	Treatment Group, n (%)	
	Group 1 n=31	Group 2 n=31
	58.35 (9.47) *	57.81 (10.48) *
Age (Years)		
<54	10 (16.1)	14 (22.6)
55- 64	13 (21.0)	9 (14.5)
65 - 74	7 (11.3)	7 (11.3)
>75	1 (1.6)	1 (1.6)
Gender		
Male	29 (46.8)	29 (46.8)
Female	2 (3.2)	2 (3.2)
Race		
Malay	24 (38.7)	18 (29.0)
Indian	3 (4.8)	4 (6.5)
Chinese	4 (6.5)	6 (9.7)
Others	0 (0.0)	3 (4.8)
Occupations		
Private	9 (14.5)	8 (12.9)
Government	7 (11.3)	3 (4.8)
Self Employed	0 (0.0)	4 (6.5)
Retired	13 (21.0)	13 (21.0)
Unemployed	2 (3.2)	3 (4.8)
Smoking History		
Non-smoker	19 (30.6)	19 (30.6)
Smoker	3 (4.8)	3 (4.8)
Ex-smoker	9 (14.5)	9 (14.5)
Education Level		
Primary	0 (0.0)	0 (0.0)
Secondary	18 (29.0)	18 (29.0)
Tertiary	13 (21.0)	13 (21.0)

Note: *Mean age with standard deviation. Otherwise, all values are in frequency and percentage.

The socio - demographic characteristics such as age, gender, races, marital status, occupations, smoking history and education level are tabulated in table 1.

Table 2. Co-morbidities and Clinical Reports among subjects

Parameter	Treatment Group, n(%)	
	Group 1 n=31	Group 2 n=31
BMI Categories		
Normal	12 (19.4)	10 (16.1)
Overweight	16 (25.8)	16 (25.8)
Overweight Class 1	2 (3.2)	5 (8.1)
Overweight Class 2	1 (1.6)	0 (0.0)
NYHA Classifications		
Class 1	0 (0.0)	0 (0.0)
Class 2	15 (24.2)	14 (22.6)
Class 3	16 (25.8)	17 (27.4)
Class 4	0 (0.0)	0 (0.0)
EF Percentages		
>50	9 (14.5)	8 (12.9)
40 – 49	16 (25.8)	15 (24.2)
30 – 39	5 (8.1)	7 (11.3)
<29	1 (1.6)	1 (1.6)

Note: All values are in frequency and percentage.

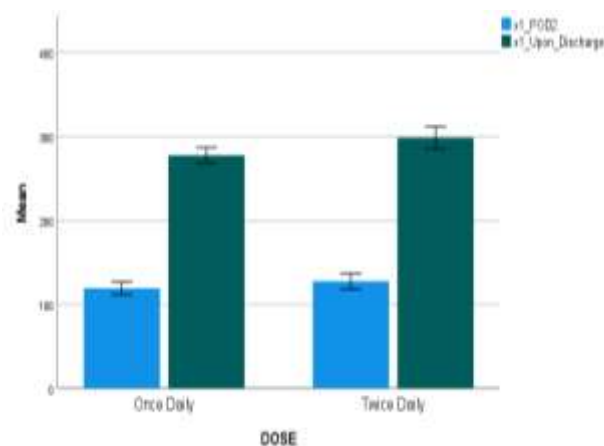
Descriptive analysis presented as mean with the standard deviation, median with IQR, and frequency with percentage. The details include the participants profile based on variables such as pre-intervention and post-intervention data which are, 6MWD during POD2 and before discharge.

Table 3. Distribution of outcomes among subjects

Parameter	Treatment Group, Mean (SD)	
	Group 1 n=31	Group 2 n=31
6MWD(m)		
POD 2	119.19 (20.90)	127.58 (24.89)
Upon Discharge	270.00 (250.00-280.00) *	290.00 (275.00 – 310.00) *

Note: *Median distance with IQR. Otherwise, all values are in mean and standard deviation.

Figure 1. Mean 6MWD during POD2 and upon discharge among subjects



Note: Error bars represent standard errors

Repeated measures ANOVA was conducted to know the effects of once and twice daily intervention on 6MWT. Firstly, within group analysis used to know the treatment effect in each group. Secondly, between group analyses were used to compare the effect of once and twice daily intervention on 6MWT (regardless of time). Then, the analysis continued to within-between groups to compare the treatment effect among the treatments group based on the time.

Table 4. Comparison of 6MWT within each treatment group based on time (time effect)

	Once daily		Twice daily	
	MD (95% CI)	p-value	MD (95% CI)	p-value
POD 2	-158.39		-170.93	
Upon Discharge	(-167.39, 149.38)	<0.001	(-182.25, 159.62)	<0.001

Note: Repeated measure ANOVA within group analyses were applied followed by multiple comparison; MD = Mean Difference, CI = Confidence Interval.

Bonferroni correction applied by correction level of significance. Significant value at $p < 0.05$.

The effectiveness of once and twice daily intervention on 6MWT among post CABG patients using repeated measure ANOVA within groups (based on time). The result presented in the Table 4.

Table 5. Describe the between group result of Group 1 and Group 2 in 6MWT in terms of Mean Difference (MD) and Confidence Interval (CI).

Comparison	6MWT		
	MD (95% CI)	p - value	F-stat (df)
Once – Twice daily	-14.66 (-26.85, -2.47)	0.019	5.79 (1)

Note: Repeated measure ANOVA between group analysis was applied. Significant value at $p < 0.05$.

There was significant difference of 6MWT between the group ($F = 5.79$, $p = 0.019$).

Table 6. Comparison of mean 6MWT based on time (Time-treatment interaction).

6MWT	Comparison	Mean Difference (95% CI)	P- value
POD 2	Once Daily	-8.387	0.156
	–Twice Daily	(-20.06, 3.29)	
Upon Discharge	Once Daily	-20.93	0.012
	–Twice Daily	(-37.09, -4.78)	

Note: Repeated measure ANOVA within-between group analyses with based on time was applied. Assumption of normality, homogeneity of variances and compound symmetry were checked and

were fulfilled. Adjustment for multiple comparisons using Bonferroni. Significant value at $p < 0.05$.

Table 6 described the comparison between once and twice daily intervention on 6MWT in terms of Mean difference and p-value for every comparison group. The Multivariate test for 6MWT-treatment interaction result based on F-test showed the p-value < 0.05 . The analysis is followed by producing means (estimated marginal means) with its confidence interval. A multiple comparison using Bonferroni revealed that there was no statistically significant difference in 6MWT distances in POD 2 between the two groups ($p = 0.156$). However, there is significant difference in the 6MWT distances upon discharge between the two groups ($p = 0.012$).

Findings from this present study stated that both once and twice daily physiotherapy intervention significantly improves 6MWT distances following CABG. Twice-daily physiotherapy intervention group had significant effects in 6MWT over once daily physiotherapy intervention ($F = 5.79$, $p = 0.019$) with a mean difference of 14.66 ± 26.84 , ± 2.47 .

A study was done by Sheraz et al., (2022) supported that 6MWD is an objective measurement tools among post CABG patients. Gremeaux et al. (2011) established 6MWD of 25 meters for the coronary artery disease (CAD) population.

Conclusion

The result of this study proposed that regardless of the dosage of once daily or twice daily physiotherapy intervention, both had significant improvement in the functional capacity. The result of twice daily on functional capacity is significantly higher than once daily even though unclear whether the between-group differences were clinically important. Similarly, both once and twice daily physiotherapy

intervention significantly improved pulmonary function.

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